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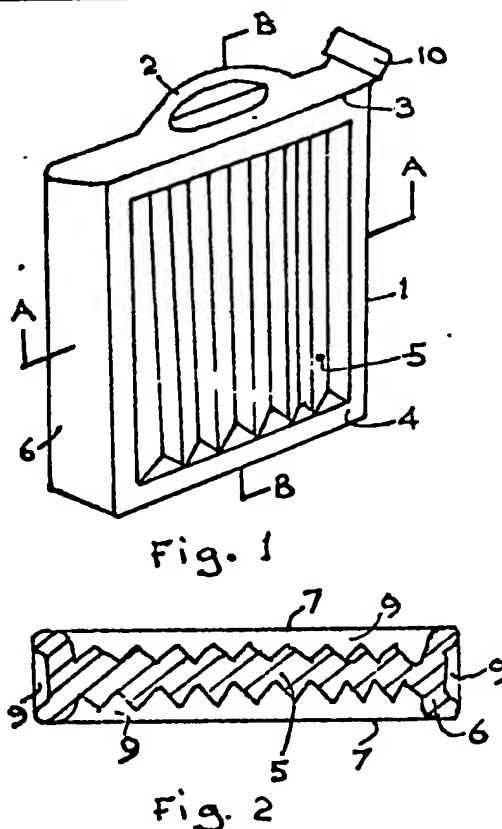
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(54) Portable solar water heater

(57) A water carrier/solar heater comprises upper and lower reservoirs 3, 4 connected by a channel 5 of lower cross-sectional area than either of the reservoirs. The connecting channel is shaped so as to form, in conjunction with the two reservoirs, one or more cavities 9 which are closed with a film 7 of material transparent to the heating rays of sunlight. These closed cavities provide thermal insulation for the water carrier/solar heater; additional thermal insulation may also be provided. Provision is also made for the water carrier/solar heater to be used as a shower bath.



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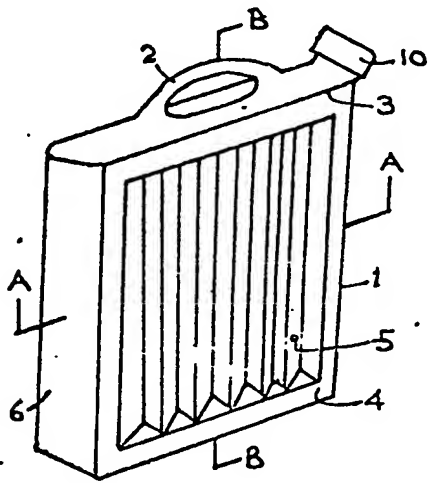


Fig. 1

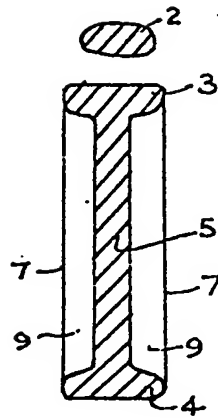


Fig. 3

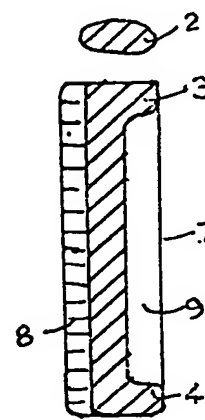


Fig. 5

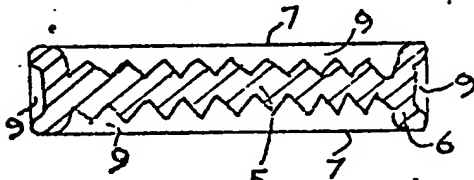


Fig. 2

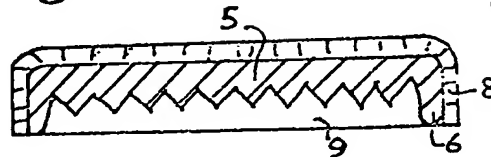


Fig. 4

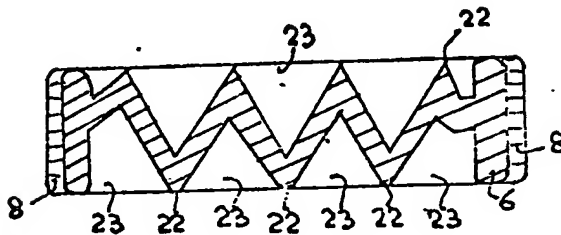


Fig. 6

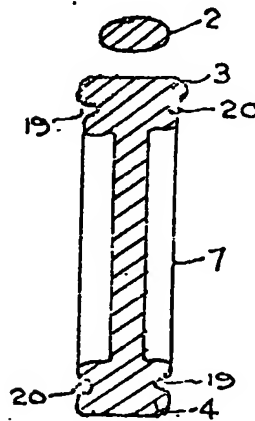


Fig. 7

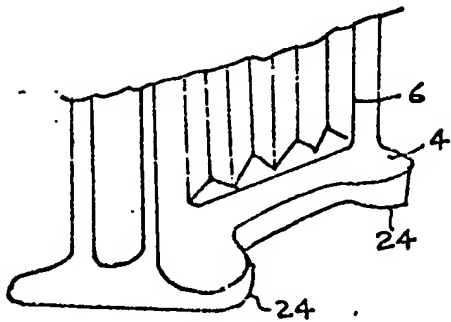


Fig. 8

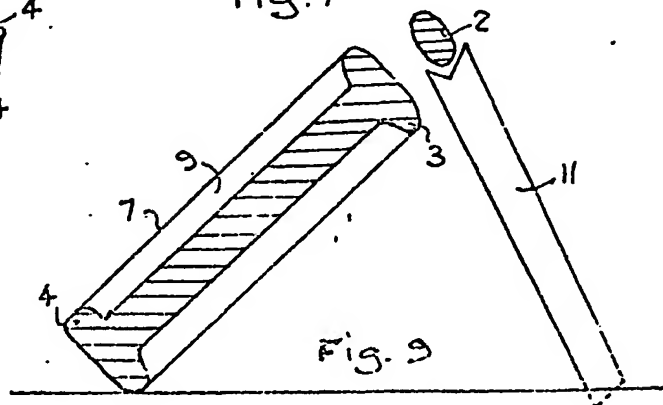
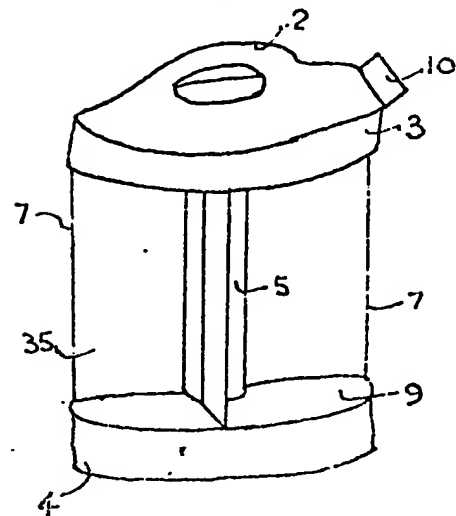
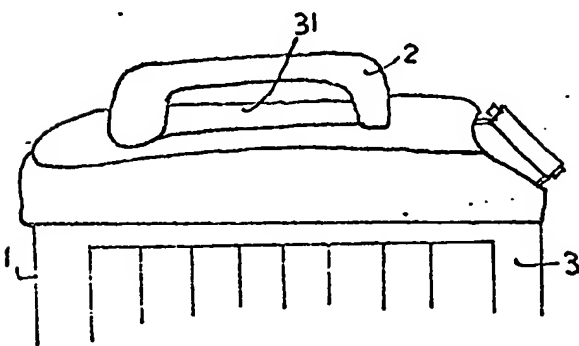
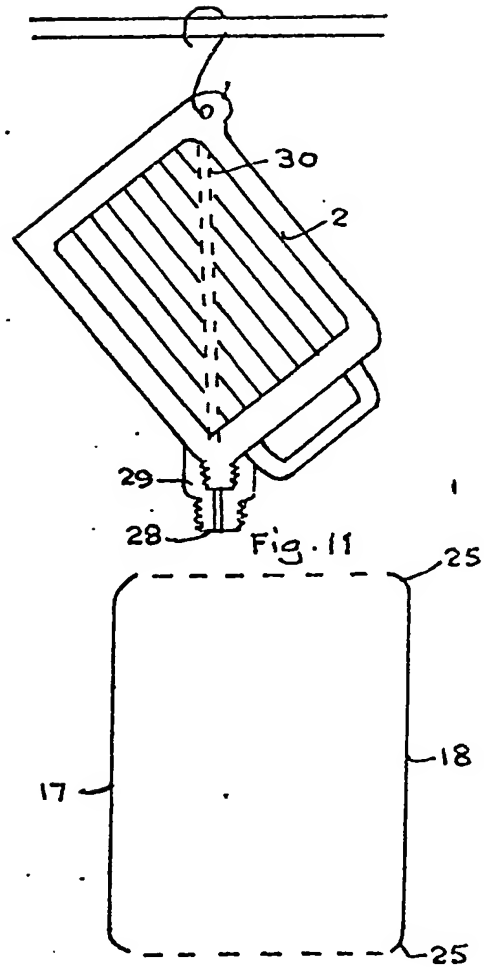
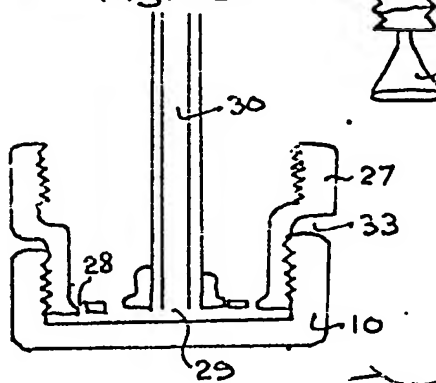
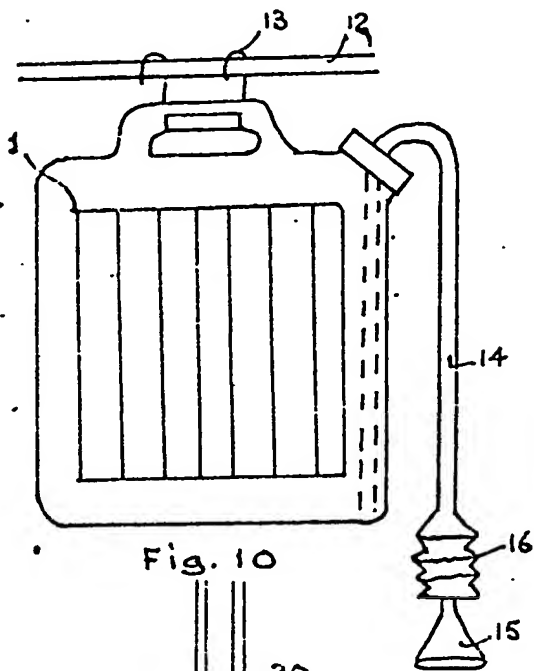


Fig. 9



**POOR QUALITY**

## SPECIFICATION

### A vessel for transporting, heating and storing water

5

The purpose of this invention is to provide a vessel for the transport and storage of relatively small quantities of water, say from 2 litres up to 30 litres or more, which will also act as a solar heater to warm the water, in situations such as camping, boating or caravanning or other activities where small quantities of heated water may be required.

The water carrier/solar heater of this invention may be made from any suitable material which will withstand temperatures up to the boiling point of water, for example, polypropylene, certain grades of polyethylene, polyvinylchloride and similar materials, or from metal, and is similar to the well-known "jerricans" already widely used for camping and similar activities. The water carrier/solar heater may be made by any of the well known techniques for shaping plastics, such as blow-moulding, vacuum-forming, rotational casting etc., or the appropriate processes for metal. To obtain the maximum heating efficiency, the water carrier/solar heater should be made from black or dark coloured material, and be thermally insulated, to prevent loss of heat to the surroundings. This thermal insulation is provided by forming recesses in the sides of the container, and covering them with a clear transparent film, thus creating a cavity in which air is trapped so as to thermally insulate the sides of the water carrier/solar heater. The use of this clear film also results in the so-called "greenhouse effect" which further increases the temperature rise. Additional thermal insulation may be provided by covering various parts of the water carrier/solar heater with thermally insulating material such as foamed plastic.

The following examples are intended to illustrate and explain, without in any way limiting, the invention.

*Figure 1* shows a general view of one form of the invention.

*Figure 2* shows section A-A of this form of the invention.

*Figure 3* shows section B-B of this form of the invention.

*Figure 4* shows section A-A of a second form of the invention.

*Figure 5* shows section B-B of the second form of the invention.

*Figure 6* shows section A-A of a third form of the invention.

*Figure 7* shows a modified section B-B that may be used with any form of the invention.

*Figure 8* shows a modified form of the base or foot of the water carrier/solar heater that may be used with any of the above forms of the invention.

*Figure 9* shows the water carrier/solar

heater in use as a solar heater.

*Figure 10* shows the water carrier/solar heater in use to provide a portable shower bath.

*Figure 11* shows an alternative way of using the water carrier/solar heater as a shower bath.

*Figure 12* shows details of the shower head used to modify the water carrier/solar heater to give the shower bath shown in *Figure 11*.

*Figure 13* shows one form of the transparent insulating cover.

*Figure 14* shows one type of insulating cover for the upper reservoir of the water carrier/solar heater.

*Figure 15* shows a form of a water carrier/solar heater in which the upper and lower reservoirs are circular in shape.

In *Figs. 1-8*, and *15* the body of the water carrier/solar heater, *1*, is formed from a suitable black or dark coloured material of either plastic or metal, to give two reservoirs, *3* & *4*, connected by a relatively narrow, recessed, heating area, *5*, with wider sections at its edges. These edge sections may also be recessed as shown in *Figure 2*. The lower reservoir has a flattened base which forms a foot on which the water carrier/solar heater may be stood in an upright position. It is advantageous for the lower reservoir to be of relatively low volume in comparison to the upper reservoir; this may be achieved by forming it into four "feet", one on each side of the base at each end of it, as shown by *24* in *Figure 8*.

The top of the water carrier/solar heater, i.e. the upper reservoir *3*, is formed so as to provide a carrying handle, *2*.

This upper reservoir will, of course, in use, contain the hottest water, and should, therefore, be thermally insulated to prevent loss of heat. This can be accomplished by fitting a thermally insulating cover, such as that shown in *Figure 14*, which is moulded from a foamed plastic material so as to fit the upper reservoir and is provided with an aperture *31*, through which protrudes the carrying handle, *2*.

To provide thermal insulation for the heating area, *5*, this area and the two end sections, are recessed, as shown by '9' in the figures, and covered with a transparent film, *7*, which traps the air in the recess and thus provides the required thermal insulation. This transparent film may be in the form of a bag or tube, which is slid over the water carrier/solar heater. This transparent film tube may advantageously be narrower at each end, as shown in *Figure 13*, and may be formed by welding together two sheets or films of plastic, the welds, *17* & *18*, having the form shown in *Figure 13*, to give the narrowed ends, *25*: the welds may be made by any of the known methods such as heat sealing or R.F. welding. In use, the narrow ends of the transparent sleeve grip the upper and lower reservoirs of the water carrier/solar heater and

hold the sleeve in place. This may be assisted by forming suitable grooves in either or both the upper and lower reservoirs, as shewn by 19 in Fig. 7. If required, an elastic band or

- 5 some other form of retainer, 20, may also be used. Alternatively, the back of the heating section may be insulated by covering it with a layer of thermally insulating material such as foamed plastic, as shewn by 8 in Figs. 4 & 5.
- 10 The water carrier/solar heater is filled with water by means of a conventional closable filler, 10, attached to the upper reservoir.
- In use, the water carrier/solar heater is filled with water, the filler cap, 10, is closed,
- 15 and the water contained in it is heated by exposing the carrier to the sun. The water carrier/solar heater may be hung from a support, or stood on or laid on the ground so as to receive the sunshine on one of its larger
- 20 sides. The sides that are not exposed to the sun are prevented from losing heat because they are thermally insulated, either by the layer of insulation, 8, or by the cavities, 9, formed, between the transparent film, 7, and the walls of the container. The layer of trans-
- 25 parent film on the side facing the sun allows the sunlight to fall almost unimpeded onto the black body of the water carrier/solar heater and heat the water container therein. For the
- 30 maximum heating effect, it is obvious that the heat-receiving face should be as nearly as possible at a right angle to the incident sunlight. This can be achieved by supporting the water carrier/solar heater at the correct angle
- 35 to the sunlight by means of a notched stick, 11, (see Fig. 9) engaging in the carrying handle, 2.

- The insulating efficiency of the cavities of trapped air, 9, may be improved by sub-
- 40 dividing them into smaller cavities. This can be accomplished as shewn in Fig. 6, by forming projecting ribs, 22, on the surface of the heating area of the water carrier/solar heater. To facilitate this, the heating area may
- 45 be given the "zig-zag" shape shewn. As shewn in Fig. 6, these ribs engage with the film 7, to sub-divide the cavity into a number of smaller cavities, 23. This will restrict the circulation of the air and thus improve the
- 50 thermal insulation.

- The water carrier/solar heater of the invention may also be used to provide a shower bath, as shewn in Fig. 10. The water carrier/solar heater is suspended from a support, 12,
- 55 such as a tent ridge pole, by means of wire hooks, 13, which engage with the handle, 2, of the water carrier/solar heater. The water is extracted by a syphon-tube 14, inserted through the filler cap, 10, terminating in a
- 60 spray head, 15. The syphon is started by means of a pump, 16, of the type used by home brewers or aquarium owners. An alternative form of shower is shewn in Fig. 11.
- Here the base or foot of the water carrier/solar heater is modified to incorporate a suspen-

- sion eye, 26, by means of which the water carrier/solar heater may be hung in an inverted position, from a support, 12, and a wire hook, 13. The filler cap is replaced by a
- 70 spray head, 27, which screws onto the filler in its place. This spray head comprises a body, 27, with a female thread, 32, which will engage with the male thread, 34, of the filler. The adjoining part of the spray head is
- 75 made to be the same diameter as the filler, so that the filler cap, 10, will screw onto the male thread, 33, that it bears. The end of the spray head terminates in a disc, perforated with a number of small holes, 28, such that
- 80 the water will emerge from them in a spray, and one hole, 29, of larger diameter through which passes a tube, 30. This tube allows air to enter the water carrier/solar heater and thus allow the water to emerge from the spray
- 85 head, in an amount that can be controlled by restricting the amount of air entering via the tube, either by squeezing the tube with the fingers, or by means of some regulating device such as a needle valve. This modified
- 90 form of the water carrier/solar heater is filled and emptied for normal use by unscrewing the complete spray head/filler cap assembly, or alternatively by removing the spray head fitting and replacing it with the filler cap.
- 95 The embodiments of this invention described so far have all utilised upper and lower reservoirs of substantially rectangular cross section, but the water carrier/solar heater of this invention can have reservoirs of
- 100 any cross section, and a water carrier/solar heater in accordance with the invention of a cylindrical type is illustrated in Fig. 15, in which a drum shaped lower reservoir, 4, is connected to a drum shaped upper reservoir,
- 105 3, by a tubular heating section, 5, onto which are formed fins, 35, extending to the periphery of the upper and lower reservoirs. The water may be made to flow through these fins if they are hollow and are connected to the
- 110 upper and lower reservoirs. These fins, in conjunction with the upper and lower reservoirs, form cavities, 9, which are sealed by the transparent film, 7, so that the air trapped therein acts as a thermal insulator to impede
- 115 the loss of heat from the water carrier/solar heater.

## CLAIMS

1. A water carrier/solar heater comprising
- 120 an upper and a lower reservoir connected together by channel of smaller cross section than either the upper or lower reservoirs this channel being shaped so as to form in conjunction with the upper and lower reservoirs
- 125 an external cavity or cavities on at least one side of the said channel the said cavity or cavities being closed by a film or sheet of a material that is substantially transparent to the heating rays of sunlight.
- 130 2. A water carrier/solar heater of the type

described in Claim 1 in which the connecting channel is shaped to provide in conjunction with the upper and lower reservoirs an external cavity closed by a sheet or film of a material substantially transparent to the heating rays of sunlight on one side of the said channel the remaining sides of the said channel being covered with thermally insulating material, to give a water carrier/solar heater of the type shewn in Figs. 4 and 5 of this Specification.

3. A water carrier/solar heater of the type described in Claim 1 in which the connecting channel is shaped to provide in conjunction with the upper and lower reservoirs external cavities closed by films or sheets of material substantially transparent to the heating rays of sunlight on all four sides of the said channel to give a water carrier/solar heater of the type shewn in Figs. 2 and 3 of the Specification.

4. Water carriers/solar heaters as described in any of the preceeding Claims in which the four lower corners of the lower reservoir are enlarged to form four feet on which the water carrier/solar heater may be stood in an upright position.

5. A water carrier/solar heater of the type described in Claim 1 in which the upper and lower reservoirs are of circular cross section and are connected by a tube of smaller diameter than either of them and in which the lower outer periphery of the upper reservoir is connected to the upper outer periphery of the lower reservoir by a continuous film or sheet of a material substantially transparent to the heating rays of sunlight.

6. A water carrier/solar heater of the type described in Claim 5 in which one or more solid or hollow fins are attached to the tube connecting the upper and lower reservoirs the said fins being also connected to the upper and lower reservoirs and engaging with the film or sheet of material which is substantially transparent to the heating rays of sunlight and which connects the peripheries of the two reservoirs so as to form a series of closed cavities between the upper and lower reservoirs to give a water carrier/solar heater of the type shewn in Fig. 15.

7. Water carriers/solar heaters as described in any preceeding Claim in which ribs are formed on the connecting channel to engage with the transparent film or sheet to sub-divide the cavity or cavities formed by the connecting channel and the upper and lower reservoirs into a number of smaller sealed cavities.

8. Water carriers/solar heaters as described in any of Claims 1, 2, 3, 5, 6, or 7, in which the base of the lower reservoir is flat to enable the water carrier/solar heater to be stood in an upright position.

9. Water carriers/solar heaters as described in any preceeding Claim in which the upper reservoir is formed to incorporate a

carrying handle.

10. Water carriers/solar heaters as described in any preceeding Claim in which grooves are formed in either or both the upper and lower reservoirs to assist the transparent film or sheet to remain in position with or without the help of retaining bands engaging in said grooves of the type illustrated in Fig. 7 of the Specification.

11. Water carriers/solar heaters as described in any preceeding Claim in which the transparent film is in the form of a tube with restricted ends of the type illustrated in Fig. 13 of the Specification.

12. Water carriers/solar heaters as described in any preceeding Claim in which the upper reservoir is thermally insulated.

13. Water carriers/solar heaters as described in any preceeding Claim in which the filler cap is modified to form a shower of the type shewn in Fig. 11 of the Specification.

14. Water carriers/solar heaters as described in any preceeding Claim in which a suspension ring, eye or lug is incorporated in the lower reservoir.

15. Water carriers/solar heaters substantially as described in the Specification and in the Examples therein.

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